# 2 - 29 Secondary Decay Effect on n/p and t/$^3$He Ratio in $^{64}$Ni+$^{58}$Ni Reaction at 40 *A*MeV

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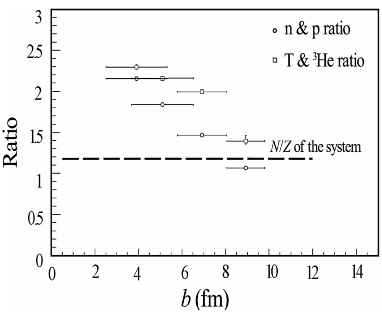


Fig. 1 The ratio between neutron and proton (○), Tritium and $^3$He (□) as a function of the impact parameter. The dashes line is the ratio of $N$ and $Z$ of the system.

The antisymmetrized molecular dynamics (AMD)[1] was used to simulate the $^{64}$Ni + $^{58}$Ni reaction at 40 *A*MeV. Events with different impact parameter ($b$) were selected by detecting the $Z_{max}$ (the maximum $Z$ number of the fragments in an event), which energy is larger than or equal with 20 MeV/u in the laboratory system, of the fragments. Then select the neutron and proton in theta angle from 60° to 120° in center-of-mass.

The n/p and t/$^3$He ratios extracted from energy spectra are plotted in Fig. 1, where the errors on the $X$ axis are from the width of the impact parameter distribution for the given $Z_{max}$ range and those in the $y$ axis are coming from constant fitting. The values for t/$^3$He are slightly higher than those for n/p in average for a given $b$, but their differences are smaller than the error bars. The average trend shows that the values are significantly deviates from $N/Z$ of the system at $b\sim 4$ and gradually decreases as $b$ increase. At $b\sim 9$ fm, and reach to the value of 1.2 of the system.

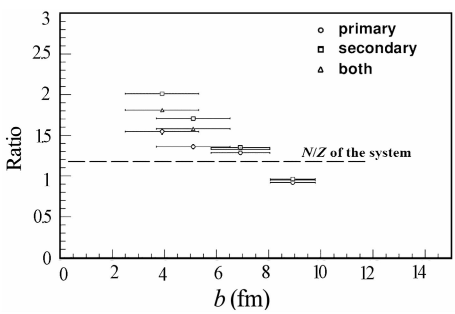


Fig. 2 The n/p multiplicity ratio vs the impact parameter.

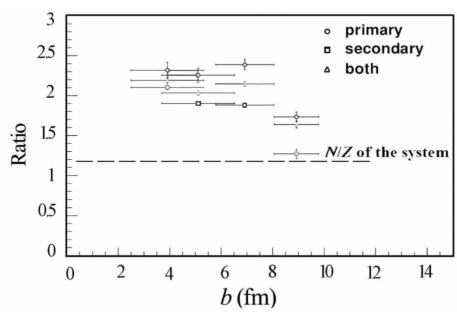


Fig. 3 The same plot as Fig. 2 for Tritium and $^3$He.

The ratio of integrated multiplicity between neutrons and protons, also tritium and $^3$He were studied. Fig. 2 shows the ratio of integrated multiplicity between neutrons and protons as a function of the impact parameter for primary alone, secondary alone and both in final products. The open circles are the ratio of primary alone, open squares are the ratio of secondary alone and the open triangles are the ratio of both in final products. The primary ratio is calculated by subtracting the secondary alone ratio from the ratio of final products of both processes, according to their multiplicity ratio. We can see that the difference of primary alone, secondary alone and both in final products ratio becomes smaller as the impact parameter increases. And when the impact parameter becomes larger, the trends changes in the same way. Also we can see when the impact parameter is smaller than 8 fm, all of the ratios are larger than the $N/Z$ ratio of the system. Fig. 3 shows the same plot as Fig. 2 for Tritium and $^3$He. The ratios be have different from the neutron and proton ratios, that is the ratio of primary alone is the largest as the impact parameter increases, the trend takes similar values to the ratio of neutron and proton, but when the impact parameter is about 7 fm, all the ratios are much higher than those of adjacent. And all the ratios are larger than the $N$ and $Z$ ratio of the system. The n/p and t/$^3$He ratios affected by the secondary decay.

## Reference

[1] A. Ono, et al., Phys. Rev., C53(1996)2958.